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RCRA, Superfund & EPCRA Hotline Training Module

Introduction to:

Hazardous Waste Incinerators
(40 CFR Parts 264/265, Subpart O)

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National toll-free (outside of DC area)	(800) 424-9346
Local number (within DC area)	(703) 412-9810
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The Hotline is open from 9 am to 6 pm Eastern Standard Time,
Monday through Friday, except for federal holidays.

HAZARDOUS WASTE INCINERATORS

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1. INTRODUCTION

Incineration has been a commonly employed technology used to destroy hazardous waste. When Congress enacted the Resource Conservation and Recovery Act (RCRA) in 1976, it directed EPA to establish performance, design, and operating standards for all hazardous waste treatment, storage, and disposal facilities (TSDFs). EPA promulgated both general facility standards that apply to all TSDFs and requirements for specific types of units (e.g., incinerators, landfills, and surface impoundments) in Parts 264 and 265. The regulations under 40 CFR Parts 264 and 265, Subpart O, apply to owners and operators of facilities that incinerate hazardous waste.

This training module introduces the concept of burning hazardous wastes in units regulated under RCRA and outlines the requirements for one type of device — the incinerator. When you have completed this module you will be able to explain what an incinerator is, understand how incinerators are regulated, and apply the appropriate regulations when assisting Hotline callers. Specifically, you will be able to:

- State the conditions under which an owner/operator may be exempt from Subpart O
- Define principal organic hazardous constituent (POHC) and describe the criteria under which a POHC is selected
- Define destruction and removal efficiency (DRE)
- Describe the interaction between compliance with performance standards and compliance with incinerator operating conditions established in a permit
- Understand the definition and purpose of a "trial burn."

Use this list of objectives to check your knowledge of this topic after you complete the training session.

2. REGULATORY SUMMARY

Waste materials are burned in incinerators, boilers, and industrial furnaces for various purposes. The purpose of the burning is directly related to the type of device. Incinerators are used primarily for the destruction of hazardous constituents; however, some energy or material recovery may occur. Boilers and industrial furnaces, on the other hand, may burn wastes for destruction, energy recovery, processing for materials recovery, or processing as ingredients. The regulations that apply to each activity vary with the type of waste that is burned, the type of combustion device, and the purpose of the burning.

The Subpart O standards for hazardous waste incinerators primarily regulate the emissions that result from the combustion process. Specifically, the regulations restrict the emissions of organics, hydrogen chloride (HCl), and particulate matter (PM), as well as fugitive emissions. A very important aspect of the regulations is that compliance with operating conditions specified in the permit is deemed to be compliance with the limits for organics, HCl, and PM.

Incinerators in existence on May 19, 1980, were allowed to continue burning hazardous waste if the units complied with the Part 265, Subpart O, interim status standards. On November 8, 1989, however, interim status terminated for all existing hazardous waste incinerators unless the owner/operator had submitted a Part B permit application by November 8, 1986 (§270.73(f)). Due to this deadline, there are very few incinerators presently operating under interim status. This module, therefore, focuses primarily on the requirements for permitted, rather than interim status, incinerators. There is a comparison of the requirements for permitted and interim status incinerators at the end of this module.

2.1 OVERVIEW OF COMBUSTION

To facilitate an understanding of the Subpart O regulations, it is important to be familiar with the combustion process itself. Incineration is the controlled burning of substances in an enclosed area. During a burn, wastes are fed into the incinerator's combustion chamber. As the wastes are heated, they are converted from solids and liquids into gases. These gases pass through the flame and are heated further. Eventually, the gases become so hot that the organic compounds in the gases break down into their constituent atoms. These atoms combine with oxygen and form stable gases that are released to the atmosphere after passing through pollution control devices.

For incineration to be an effective method for destroying wastes' hazardous properties, combustion must be complete. Three critical factors ensure the completeness of combustion in an incinerator: (1) the temperature in the

combustion chamber, (2) the length of time wastes are maintained at high temperatures, and (3) the turbulence, or degree of mixing, of the wastes and the air. Operating conditions are specified in each incinerator permit to ensure that these factors promote complete combustion.

The stable gases produced by incineration are primarily composed of carbon dioxide and water. Depending on waste composition, however, small quantities of carbon monoxide, nitrogen oxides, HCl, and other gases may form. RCRA regulations control the amount of HCl released from the air pollution control device (APCD).

Another by-product of the combustion process is ash. Ash is an inert solid material composed primarily of carbon, salts, and metals. During combustion, most ash collects at the bottom of the combustion chamber (bottom ash). When this ash is removed from the combustion chamber, it may be considered hazardous waste via the derived-from rule or because it exhibits a characteristic. Some ash, however, is carried up with the gases as small particles, or particulate matter. These particles are also collected in the APCD in accordance with RCRA-established limits.

As a hazardous waste management technology, incineration has several unique attributes. First, it permanently destroys toxic organic compounds contained in hazardous waste by breaking their chemical bonds and reverting them to their constituent elements, thereby reducing or removing their toxicity. Second, incineration reduces the volume of hazardous waste by converting solids and liquids to ash. Land disposal of ash, as opposed to untreated hazardous waste, is therefore both safer and more efficient. Incineration, however, will not destroy inorganic compounds such as metals present in hazardous waste. Residue ash from incinerators is subject to applicable RCRA standards and may need to be treated for metals or other nonorganic constituents prior to land disposal.

2.2 SUBPART O APPLICABILITY

The Subpart O standards apply to hazardous waste that is treated or destroyed in devices which meet the definition of an incinerator. An incinerator is any enclosed device that uses controlled flame combustion and does not meet the criteria for classification as a boiler, sludge dryer, carbon regeneration unit, or industrial furnace. The definition of incinerator specifically includes units that meet the definition of infrared incinerator or plasma arc incinerator. An infrared incinerator is any enclosed device that uses electric-powered resistance as a source of heat and which is not listed as an industrial furnace. A plasma arc incinerator is any enclosed device using a high intensity electrical discharge as a source of heat which is not listed as an industrial furnace. Other types of incinerators include rotary kilns, liquid injectors, controlled air incinerators, and fluidized bed incinerators.

All devices classified as incinerators which burn hazardous waste must follow the Subpart O standards, with the following exception. The Regional Administrator must exempt an owner/operator applying for a permit from all of the incinerator standards in Subpart O, except waste analysis and closure, if the hazardous waste fed into an incinerator is considered low risk waste (§264.340). The criteria for defining a waste as low risk are:

- The waste is a hazardous waste listed in Part 261, Subpart D, or identified in Subpart C only for ignitability, corrosivity, or both

or

- The waste is a hazardous waste listed in Part 261, Subpart D, or identified in Subpart C only for reactivity, and will not be burned with other hazardous wastes (this exemption does not apply to wastes that are reactive for generating toxic gases, cyanide or sulfide gases)

and

- The waste contains none of the hazardous constituents listed in Appendix VIII of Part 261.

2.3 PERFORMANCE STANDARDS

The Subpart O standards for hazardous waste incinerators set performance standards which limit the quantity of gaseous emissions an incinerator may release. Specifically, the regulations set limits on the emission of organics, HCl, and PM. The following section outlines the requirements for each of these substances.

ORGANICS

To obtain a permit, an owner/operator must demonstrate that emission levels set for various hazardous organic constituents are not exceeded. EPA's principle measure of incinerator performance is its destruction and removal efficiency (DRE). A 99.99 percent DRE means that one molecule of an organic compound is released to the air for every 10,000 molecules entering the incinerator. A 99.9999 percent DRE means that one molecule of an organic compound is released to the air for every one million molecules entering the incinerator.

Since it would be impossible to monitor the DRE results for every organic constituent contained in a waste, certain principal organic hazardous constituents (POHCs) are selected for monitoring and are designated in the permit. POHCs are selected based on high concentration in the waste feed and difficulty in burning compared to other organic compounds. If the incinerator achieves the required DRE for the selected POHCs, then the incinerator should achieve the same or better DRE for organic compounds that are easier to incinerate.

RCRA performance standards require a minimum DRE of 99.99 percent for POHCs designated in the permit and a minimum destruction and removal efficiency of 99.9999 percent for dioxin-bearing wastes F020, F021, F022, F023, F026, or F027 (§264.343(a)).

HYDROGEN CHLORIDE

Hydrogen chloride (HCl) is an acidic gas that forms when chlorinated organic compounds in hazardous wastes are burned. An incinerator burning hazardous waste cannot emit more than 1.8 kg of HCl per hour or more than 1 percent of the total HCl in the stack gas prior to entering any pollution control equipment, whichever is larger (§264.343(b)).

PARTICULATE MATTER

Particulate matter, or PM, is tiny particles of ash that are carried along with the combustion gases to the incinerator's stack. The regulations control metal emissions through the performance standard for particulates, since metals are often contained in or attached to the particulate matter. A limit of 180 milligrams of particulate matter per dry standard cubic meter of gas emitted through the stack has been established in §264.343(c).

2.4 OPERATING STANDARDS

The goal of setting operating conditions for hazardous waste incinerators is to ensure compliance with the performance standards discussed in the previous section (i.e., for POHCs, HCl, and PM). An incinerator permit specifies operating conditions that have been shown in a trial burn to result in the incinerator meeting these performance standards. A very important aspect of the regulations is that compliance with the operating conditions specified in the permit is deemed to be compliance with the performance standards for organics, HCl, and PM (§264.343(d)).

A RCRA permit for a hazardous waste incinerator sets operating conditions that specify allowable ranges for and requires continuous monitoring of certain critical parameters. Operation within these parameters ensures that the combustion is performed in the most protective manner and the performance standards are achieved. These parameters, or operating conditions, include (264.345(b)):

- Maximum allowable carbon monoxide levels in stack emissions
- Allowable ranges for temperature
- Maximum waste feed rates
- Combustion gas velocity
- Limits on variations of system design and operating procedures.

During the start up and shut down of an incinerator, hazardous waste must not be fed into the unit unless it is operating within the conditions specified in the permit (§264.345(c). An incinerator must cease operations when changes in waste feed, incinerator design, or operating conditions exceed limits designated in its permit (§264.345(f)).

FUGITIVE EMISSIONS

Operating conditions are also set to control emissions escaping from the combustion zone. Fugitive emissions are gases that escape from the combustion chamber (for example, gases may escape through the opening where wastes are fed into the combustion chamber) and do not pass through pollution control devices. The two control methods are (1) maintaining negative pressure in the combustion zone so that air will be pulled into the device rather than allowing pollutants to escape before they go through air pollution control equipment, or (2) totally sealing the combustion chamber so that no emissions can escape to the environment (§264.345(d)).

2.5 PERMIT PHASES

An owner/operator wishing to operate a new hazardous waste incinerator is required to obtain a RCRA permit before construction of the unit commences. The purpose of a hazardous waste incinerator permit is to allow a new hazardous incinerator to establish conditions including, but not limited to, allowable waste feeds and operating conditions that will ensure adequate protection of human health and the environment. The incinerator permit covers four phases of operation: pre-trial burn, trial burn, post-trial burn, and final operating conditions (§270.62).

PRE-TRIAL BURN

The pre-trial burn phase of the permit allows the incinerator to achieve a state of operational readiness necessary to conduct the trial burn. The pre-trial burn permit conditions are effective for the minimum time (not to exceed 720 hours) required to bring the incinerator to a point of operational readiness to conduct a trial burn. This phase is often referred to as the shakedown period.

TRIAL BURN

EPA establishes conditions in the permit necessary to conduct an effective trial burn, meaning that the burn will be representational of the incinerator's actual operation and will yield meaningful data for analysis. These conditions are based on the operating conditions proposed by the permit applicant in the trial burn plan submitted to EPA.

POST-TRIAL BURN

To allow the operation of a hazardous waste incinerator following the completion of the trial burn, EPA establishes permit conditions sufficient to meet the incinerator performance standards. This post-trial burn period is limited to the minimum time required to complete the sampling, analysis, data computation of trial burn results, and submission of these results to EPA.

FINAL OPERATING CONDITIONS

After reviewing the results of the trial burn, EPA will modify as necessary the operating conditions of the incinerator to ensure compliance with incinerator standards and protection of human health and the environment. Owners/operators of incinerators must comply with the final permit conditions for the duration of the permit, or until the permit is modified.

DATA IN LIEU OF TRIAL BURN

While most incinerators must undergo a trial burn, it is possible for a facility to submit extensive information in lieu of the trial burn (§270.19(c)). EPA believes that most combustion units will need to conduct trial burns in order to develop operating conditions that ensure compliance with the performance standards. Data submitted in lieu of the trial burn, therefore, must originate from a unit with a virtually identical design that will burn wastes under virtually identical conditions (located at the same facility).

2.6 WASTE ANALYSIS

During operation, the owner/operator of an incinerator must conduct sufficient waste analyses to verify that the waste feed is within the physical and chemical composition limits specified in the permit. This analysis may include a determination of heat value, viscosity, and content of hazardous constituents, including POHCs. Waste analysis also comprises part of the trial burn permit application (§264.341). EPA stresses the importance of proper waste analysis to ensure compliance with emission limits.

2.7 MONITORING AND INSPECTIONS

The specific monitoring and inspection requirements for incinerators are found in §264.347. The owner/operator must perform, at a minimum, the following functions while incinerating hazardous waste:

- Monitor the combustion temperature, waste feed rate, and indicator of combustion gas velocity on a continuous basis
- Monitor carbon monoxide on a continuous basis at a point downstream of the combustion zone and prior to release into the atmosphere
- Sample and analyze the waste and exhaust emissions upon request of the Regional Administrator to verify that the operating requirements established in the permit achieve the performance standards
- Conduct daily visual inspections of the incinerator and associated equipment
- Test the emergency waste feed cut-off system and associated alarms at least weekly unless otherwise directed by the Regional Administrator — at a minimum operational testing must be conducted monthly
- Place monitoring and inspection data in the operating log.

2.8 MANAGEMENT OF RESIDUES

If an incinerator burns a listed hazardous waste, the ash is also considered a listed waste. The derived-from rule states that any solid waste generated from the treatment, storage, or disposal of a listed hazardous waste, including any sludge, spill residue, ash, emission control dust, or leachate, remains a hazardous waste unless and until delisted (§261.3(c)(2)(i)). The owner/operator must also determine whether the ash exhibits any characteristics of a hazardous waste.

If an incinerator burns waste that only exhibits a characteristic of a hazardous waste, the owner/operator must determine whether the ash exhibits any characteristics. Ash that exhibits a characteristic must be managed as a hazardous waste.

2.9 CLOSURE

At closure, the owner/operator must remove all hazardous waste and hazardous residues from the incinerator equipment site. In addition, as throughout the operating period, unless the owner/operator can demonstrate that the residue removed from the incinerator is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage the residue in accordance

with the applicable requirements of Parts 262 through 266. (The module entitled Closure/Post-Closure provides more detailed information.)

2.10 COMPARISON OF PERMITTED AND INTERIM STATUS INCINERATORS

Figure 1 compares the requirements for permitted and interim status incinerators.

Figure 1
COMPARISON OF PARTS 264/265
INCINERATOR REQUIREMENTS

PART 264, PERMITTED	PART 265, INTERIM STATUS
WASTE ANALYSIS (§264.341) Heat Value Viscosity Appendix VIII	**WASTE ANALYSIS (§265.341)** Heating valve Waste halogen and sulfur content Waste lead and mercury content
PERFORMANCE STANDARDS (§264.343) 99.99% DRE for POHCs 99.9999% DRE for dioxins 1.8 kg/hr or 1% HCl emissions 180 mg/DSCM particulate	**PERFORMANCE STANDARDS (§§265.345 and 265.352)** Operate only during steady state 99.9999% DRE for dioxins
MONITORING & INSPECTIONS (§264.347) Combustion temperature Waste feed rate Combustion gas velocity Carbon monoxide (CO) Daily inspections Weekly operational testing	**MONITORING & INSPECTIONS (§265.347)** Monitor emissions control systems every 15 minutes Daily inspections Daily operational testing
CLOSURE (§264.351) Remove all hazardous waste and residues	**CLOSURE (§265.351)** Remove all hazardous waste and residues

3. REGULATORY DEVELOPMENTS

On April 19, 1996, EPA published a proposed rule under the joint authority of RCRA and the Clean Air Act to revise the technical standards for hazardous waste combustors (61 FR 17358). Specifically, this rule will affect incinerators, cement kilns, and lightweight aggregate kilns. EPA plans to address boilers and other industrial furnaces in a future rulemaking. This rule fulfills EPA's commitment to upgrade emissions standards as stated in its 1993 Hazardous Waste Minimization and Combustion Study.

The rule proposes emissions standards for dioxins, furans, mercury, cadmium, lead, particulate matter, chlorine, carbon monoxide, and several low-volatility metals. It also proposes a new comparable fuels exclusion, and makes significant changes to the existing combustion regulations. A final rule is expected in December 1996.

4. SPECIAL ISSUES

As EPA continues to revise the regulatory program for incinerators in order to adequately protect human health and the environment, omnibus permitting authority and public participation issues have received greater attention. The following discusses both issues in greater detail.

4.1 OMNIBUS PERMITTING AUTHORITY

The omnibus provision, added by Congress in the 1984 Hazardous and Solid Waste Amendments, allows the Regional Administrator or state to incorporate any provision into a permit deemed necessary to protect human health and the environment. EPA codified this authority in §270.32(b)(2). Even if a facility submits a permit application that is complete and technically adequate, if site-specific factors at the facility will not assure protection of human health and the environment, the Agency can impose additional conditions that will ensure it does. Regulators can invoke the omnibus authority whenever a facility owner/operator is seeking a new permit, reissue of an expiring permit, or when existing permits are reopened for modification (in appropriate circumstances).

EPA has recommended that permit writers invoke the omnibus provision to more stringently control emissions for toxic metals, HCl, and products of incomplete combustion (PICs); and to enhance public participation in the combustion permitting process. Also, under the Strategy for Hazardous Waste Minimization and Combustion, EPA has directed states and regions to conduct site-specific risk assessments (incorporating direct and indirect exposures) using the omnibus authority. These risk assessments should be conducted by the implementing agency during the permitting process.

4.2 PUBLIC PARTICIPATION

On December 11, 1995, EPA published a final rule expanding the role of public participation in the RCRA permitting process. This rule affects incinerators by increasing the extent of public participation during the trial burn process (60 FR 63417). Specifically, the permitting agency is required to issue a public notice prior to approving a facility's trial burn plan, and must announce the commencement and completion dates for all trial burns. The proposed public participation rule (59 FR 28680; June 2, 1994) also included some changes to the procedural requirements for permitting interim status facilities. These changes, however, were not finalized because of pending technical revisions to the hazardous waste combustor standards. See the Regulatory Development section of this module for a discussion of this proposed rule.